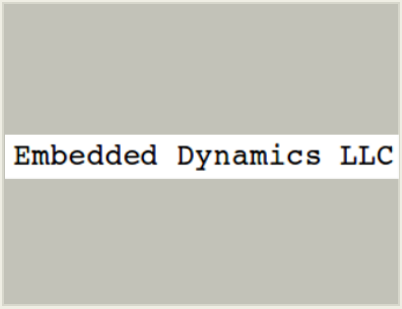
Maneuvering Environment for Tiltwing Aircraft with Distributed Electric Propulsion, Phase I

Completed Technology Project (2017 - 2018)

Project Introduction

The tiltwing class of aircraft consists of vehicles with the ability to rotate the wing and propulsion system as a unit a full 90 degrees from the standard fixed wing configuration to one in which the wing and thrust axis become perpendicular to the body axis. This thrust vectoring capability allows the aircraft to utilize thrust borne flight for vertical takeoff and landing as well as the conventional configuration for more efficient lift borne flight operations. The pitching moment is typically controlled by one or more propellers that is/are either mounted statically to the tail (Canadair CL-84) or attached to an articulated tail wing plane (NASA GL-10). In contrast to a tiltrotor, the lifting and control surfaces of a tiltwing are immersed in the slipstream of the attached propellors, potentially delaying the onset of stall during transitions and also allowing, for example, the ailerons to provide some yaw control in the hover configuration. Distributed Electric Propulsion (DEP) is a natural enhancement for tiltwing aircraft, where additional thrust can be used in vertical take-off and landing (and transition) operations and then scaled back (and tucked away) for conventional flight operations. The use of a centralized electric power plant for DEP leads to an increased payload capacity without large sacrifices in endurance and efficiency, all while maintaining its VTOL capabilities. Our goal is the development of a flight maneuvering system for distributed electric propulsion, toward this end we propose the development of model analysis and design tools and techniques focused in particular on the transition maneuvers. The proposed innovation will facilitate the development of analytical tools and methods with which to assess the tiltwing vehicles using DEP; this includes aerodynamic force and moment models for transition, dynamic simulations for trajectory exploration, and tools for trajectory optimization.



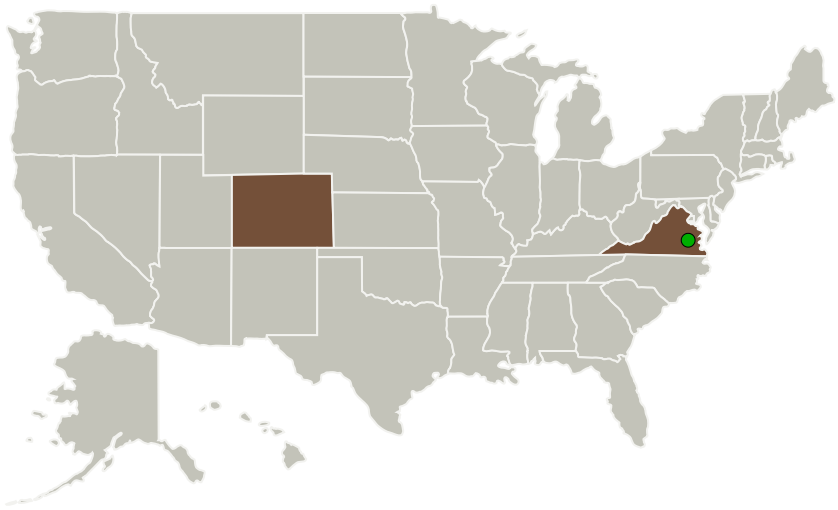
Maneuvering Environment for Tiltwing Aircraft with Distributed Electric Propulsion, Phase I Briefing Chart Image

Table of Contents

Maneuvering Environment for Tiltwing Aircraft with Distributed Electric Propulsion, Phase I

Completed Technology Project (2017 - 2018)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Embedded Dynamics	Lead Organization	Industry	Boulder, Colorado
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia
University of Colorado Boulder	Supporting Organization	Academia	Boulder, Colorado

Primary U.S. Work Locations	
Colorado	Virginia

Project Transitions

June 2017: Project Start

June 2018: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140849)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Embedded Dynamics

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

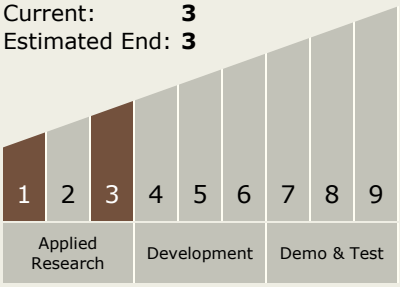
Carlos Torrez

Principal Investigator:

John Hauser

Technology Maturity (TRL)

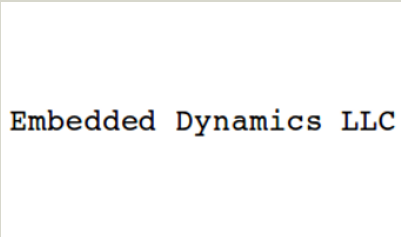
Start: **1**
Current: **3**
Estimated End: **3**



Maneuvering Environment for Tiltwing Aircraft with Distributed Electric Propulsion, Phase I

Completed Technology Project (2017 - 2018)

Images



Briefing Chart Image
Maneuvering Environment for Tiltwing Aircraft with Distributed Electric Propulsion, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/134120)

Technology Areas

Primary:

- TX15 Flight Vehicle Systems
  - TX15.1 Aerosciences
    - TX15.1.6 Advanced Atmospheric Flight Vehicles

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System